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(54) **Device for transport along incline or staircase**

Vorrichtung zur Beförderung entlang eine Steigung oder eine Treppe

Dispositif pour le transport le long d'une montée ou d'un escalier

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**EP-A- 0 143 737** **WO-A-97/39972**

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## Description

**[0001]** The present invention relates to a device for ascending or descending an incline or staircase, such as a stair lift, a stair walking aid or a wheelchair lift, which device is displaceable along at least one elongate guide disposed along the incline or staircase.

**[0002]** Such a device is known from the European patent application 0.143.737. The device known herefrom is displaceable along two guides which run mutually parallel and which are curved three-dimensionally. Driving of the device along the guides takes place with a type of toothed wheel as component of a drive mechanism, which toothed wheel engages teeth on one of the two guides and wherein the wheel is driven.

**[0003]** The known device has the drawback that in order to follow the three-dimensionally curved form of particularly the guide along which the device is driven, the toothed wheel is pivotable three-dimensionally in a voluminous construction, which also comprises a counter-wheel for clamping the guide. This construction is bulky because use is made of a configuration comparable to a planetary gear system, wherein three axes of rotation are applied which are mutually intersecting in the central axis of the guide. The configuration is also bulky because of the space required to realize the three axes of rotation located at a mutual distance. Particularly when the known device is used along a staircase, where there is usually only a limited amount of space available, the device, as a result of the voluminous configuration of the drive mechanism, forms an obstruction for persons who wish to walk along the staircase or incline without using the device.

**[0004]** Another drawback of the known device is that the rotation axes in the drive mechanism are not fully independent of each other geometrically, so that negotiation of a curve in the guide with a small radius is very difficult and, insofar as it is successful, is only achieved in a jerky manner.

**[0005]** In addition, the configuration of the drive mechanism of the known device is substantially open, which can cause a safety problem. There is the possible risk of items of clothing, or even body parts, being caught between the guide and the drive mechanism due to the open nature thereof.

**[0006]** The present invention has for its object to obviate or at least diminish the above stated problems, for which purpose a device is provided which is distinguished in that it comprises:

- a carriage which is displaceable along the guide and on which can be arranged assist means for ascending or descending, such as a walking frame, a tiltable seat or lift platform; and
- at least one drive mechanism mounted on the carriage for engaging the guide,

wherein the drive mechanism is substantially ball-

shaped and is connected to the frame with forming of a ball joint.

**[0007]** A device and particularly a drive mechanism according to the present invention provides a very compact configuration with which space is saved. It is moreover possible with a ball-shaped drive mechanism which forms a ball joint in the frame to pass smoothly through extremely short bends.

**[0008]** A device according to the present invention preferably has the feature that at least two drive mechanisms, each forming a ball joint, are connected to the carriage, wherein at least in respect of position the drive mechanisms are independent of each other relative to the carriage and the guide.

**[0009]** In such a configuration an extremely high stability of the device is provided during movement in the lengthwise direction of the guide, in both loaded and unloaded state.

**[0010]** In another preferred embodiment a device according to the invention has the feature that the at least one drive mechanism is connected to a drive for advancing the carriage along the guide.

**[0011]** A further space saving is achieved by a combination of the drive mechanism and the drive, which for instance increases the space on a staircase which remains available for users who make no use of the device.

**[0012]** In a device with two drive mechanisms, wherein at least one drive mechanism is connected to a drive, a device according to the invention can have the feature that either of the at least two drive mechanisms is each connected to a separate drive.

**[0013]** Due to the absence of rigid joints between the drive and the two drive mechanisms an independent position determination becomes possible and two lighter motors can be used instead of one relatively heavy motor, which particularly in the negotiating of a bend could cause an imbalance in the tensile force between the two drive mechanisms. Integrating of two motors further provides an increased certainty, so that no additional provisions are required for this purpose, such as speed-limiters and a braking mechanism. It is noted that a braking mechanism is used to block a fall along the guide of the device should a device with a single motor fail. By providing two motors full functioning of the device can be performed, within a good margin of certainty, by a single motor if the other one were to fail. An additional braking mechanism is thus no longer necessary.

**[0014]** In another embodiment of the invention a device has the feature that between the carriage and the at least one drive mechanism forming a ball joint is arranged a limiter for limiting the position hereof relative to the carriage and to the guide. A safe, practical and advantageous embodiment is hereby provided.

**[0015]** At least one support wheel is advantageously arranged in the interior of at least one ball-shaped drive mechanism. This support wheel can support against a gear rack on the guide, so that apart from the ball-

shaped drive mechanism no extra provisions have to be made for this purpose. With the support wheel the ball-shaped drive mechanism is then held upright relative to this gear rack, while further space is saved once again.

**[0016]** In yet another embodiment a device with at least one drive mechanism, which is connected to a drive for advancing the carriage along the guide, has the feature that at least one drive wheel is arranged in the interior of the at least one ball-shaped drive mechanism. This also achieves an additional space-saving since no separate drive wheel has to be arranged outside the ball-shaped drive mechanism.

**[0017]** An embodiment of a device according to the present invention will be described hereinbelow by way of example with reference to the annexed drawing, in which:

fig. 1 shows a perspective view of a device according to the invention in operation;

fig. 2 shows a perspective view of a detail of the device shown in fig. 1;

fig. 3 and 4 show in more detail perspective views of drive mechanisms of fig. 2; and

fig. 5 shows a view corresponding with fig. 2 in the situation assembled with the guide and in another relative position of the ball-shaped drive mechanisms.

**[0018]** Fig. 1 shows a device 1 according to the present invention. Device 1 is displaceable along a guide 2 comprising a tube 5, which tube 5 is curved three-dimensionally and wherein a gear rack 6 is arranged on the underside of tube 5 in the embodiment shown here.

**[0019]** Device 1 comprises a carriage 3 on which a seat 4 and a foot rest 7 are tiltably arranged.

**[0020]** In the embodiment shown here the guide 2 will extend along a staircase, wherein device 1 serves to enable transport of persons upward and downward along the staircase on seat 4, without these persons having to walk along the stairs.

**[0021]** The carriage 3 is closed with a housing 8.

**[0022]** In fig. 2 is shown a perspective view of carriage 3 from which a part of housing 8 is removed in order to make visible the diverse components in the interior thereof. Carriage 3 comprises a frame 10 on which a bracket 9 is arranged in tiltable and driven manner. Seat 4 of fig. 1, or alternatively a platform if the device is a wheelchair lift, can be mounted on bracket 9. Bracket 9 can be tilted in order to hold seat 4 or alternatively the platform upright, irrespective of the position of carriage 3.

**[0023]** Two drive mechanisms 11 are arranged in frame 10. Drive mechanisms 11 are each connected to the frame with forming of a ball joint and are each at least partly ball-shaped. Drive mechanisms 11 are thus freely rotatable on their imaginary centre (not designated with a reference numeral). However, a limiter to be

further described hereinbelow limits the freedom of movement to the necessary range.

**[0024]** The ball-shaped drive mechanisms 11 each have a passage 12 through which the guide runs in the mounted state of carriage 3. Particularly on the upper side of passage 12 in fig. 2 are arranged support wheels 13 which in the mounted state lie against tube 5 of guide 2. Carriage 3 is as it were suspended from guide 2 on these wheels.

**[0025]** At least one of the drive mechanisms 11 is provided with a limiter 23. In a particularly simple embodiment as shown in fig. 2, the limiters comprise bolt 24 which protrudes into a passage 25 in a bottom plate 26 of frame 10. The edges of passage 25 form a stop for bolt 24, whereby the angle of rotation of drive mechanism 11 is limited within boundaries corresponding with the edges of opening 25.

**[0026]** It is noted that fig. 5 shows a suspension 27 which is fixed to the tube 5 of guide 2 and forms a connection to a support construction, such as a wall. The support wheels 13 shown in fig. 5 herein pass along the top of suspension 27 and the parts of drive mechanisms 11 situated under tube 5 also run clear of this suspension 27.

**[0027]** The drive mechanisms 11 will be further elucidated hereinbelow with reference to fig. 3 and 4, where one of the drive mechanisms 11 is shown in each case in different perspective views.

**[0028]** In the embodiment shown here the drive mechanisms 11 comprise metal bodies 15, of which at least a part of the outer surface is spherical 14. This spherical part 14 is accommodated in frame 10 in a manner corresponding with a ball bearing, as shown in fig. 2. Drive mechanisms 11 can thus rotate round their imaginary centre. Independently of each other the drive mechanisms 11 can herein take up a position corresponding with the progression of guide 2. Because drive mechanisms 11 are received in the frame as ball joints and can rotate round their imaginary centre, they take up such positions corresponding to the progression of guide 2 in a very smooth manner, without jerking and jolting.

**[0029]** Fig. 4 shows that additional running wheels 16 are provided which, due to their contact with the gear rack, maintain the orientation of drive mechanisms 11 relative to the tube 5 of guide 2. In this embodiment further running wheels 18 are situated with their running surface against strip 18 on the side surface 17 of gear rack 6 so as to thus effect an advantageous play of forces.

**[0030]** While the orientation of drive mechanisms 11 relative to guide 2 is maintained in this manner, a drive for the bracket 9, which is arranged tiltably on carriage 3, ensures that seat 4 of fig. 1, or alternatively a platform or the like, is held upright. This drive is not per se part of the present invention and description thereof will further be dispensed with.

**[0031]** Also arranged in body 15 is a drive wheel 19 which is connected to an electric motor 21 via a trans-

mission 20. Drive wheel 19 is a toothed wheel which acts, when driven by electric motor 21, on the gear rack 6 of guide 2. Carriage 3 can hereby be driven up and down along guide 2. As shown in fig. 2 and also in fig. 5, a battery or batteries 22 is or are arranged on frame 10, which serve for electrical power supply to electric motors 21. Alternatively, another form of energizing of a drive can of course also be chosen, which is well within the reach of the person with ordinary skill in the art. Fig. 5 otherwise shows carriage 3 of fig. 2 in a situation where it is assembled with guide 2.

**[0032]** In the embodiment shown here, each of the drive mechanisms 11 comprises a drive. A single drive mechanism 11 with drive, or even a drive separate of drive mechanisms 11, is possible within the scope of the present invention. By providing both drive mechanisms 11 with a separate drive the safety of device 1 is increased. One of the two motors can break down, whereafter device 1 continues to function properly. A braking mechanism to prevent device 1 falling downward out of control along guide 2 is therefore no longer strictly necessary. Additionally or alternatively, both motors can take a relatively light form.

**[0033]** The position of carriage is substantially determined by the connecting line between the imaginary centres of drive mechanisms 11, which are substantially ball-shaped. Because drive mechanisms 11 are substantially ball-shaped, the space required therefor is minimal, as is the distance between the imaginary centres thereof. A very short bend, i.e. a bend with a small radius, can thus be passed smoothly. Also possible within the scope of the present invention is a single drive mechanism which is ball-shaped and connected to the frame with forming of a ball joint. A considerable space-saving and a very smooth travel behaviour and rotation behaviour are both retained. For the purpose of position determination of the carriage relative to the guide, a number of running wheels can then simply be provided round the periphery of the guide instead of the second ball-shaped drive mechanism 11 described in the above specified embodiment.

**[0034]** Because the drive mechanisms according to the invention are ball-shaped, they will, when a drive is also incorporated therein, screen the contact area between inter alia the drive and guide 2, thus providing a safety against the possible danger of items of clothing and/or body parts being caught between the drive and the guide.

**[0035]** As will be apparent from the foregoing, many alternative and additional embodiments are possible within the scope of the present invention as defined in the appended claims, which embodiments will occur to a skilled person after examination of the foregoing. Possibilities are thus described wherein only one ball-shaped drive mechanism is applied, a plurality of drive mechanisms can be used which are not each provided with a separate drive, and so on.

## Claims

1. Device for ascending or descending an incline or staircase, such as a stair lift, a stair walking aid or a wheelchair lift, which device (1) is displaceable along at least one elongate guide (2) disposed along the incline or staircase, and comprises:

- a carriage (3) which is displaceable along the guide (2) the carriage comprising a frame (10) and on which carriage can be arranged assist means for ascending or descending, such as a tiltable seat or lift platform; and
- at least one drive mechanism (11) mounted on the carriage (3) for engaging the guide (2), **characterized in that**

the drive mechanism is substantially ball-shaped and is connected to the frame (10) thereby forming a ball joint.

2. Device as claimed in claim 1, wherein at least two drive mechanisms (11), each forming a ball joint, are connected to the carriage (3), wherein at least in respect of position the drive mechanisms (11) are independent of each other relative to the carriage (3) and the guide (2).

3. Device as claimed in claim 1 or 2, wherein the at least one drive mechanism (11) is connected to a drive (21) for advancing the carriage (3) along the guide (2).

4. Device as claimed in claims 2 and 3, wherein either of the at least two drive mechanisms (11) is each connected to a separate drive (21).

5. Device as claimed in any of the foregoing claims, wherein between the carriage (3) and the at least one drive mechanism (11) forming a ball joint is arranged a limiter (23) for limiting the position hereof relative to the carriage (3) and to the guide (2).

6. Device as claimed in any of the foregoing claims, wherein at least one support wheel (13) is arranged in the interior of the at least one ball-shaped drive mechanism (11).

7. Device as claimed in any of the claims 3-6, wherein at least one drive wheel (19) is arranged in the interior of the at least one ball-shaped drive mechanism (11).

## Patentansprüche

1. Vorrichtung für die Aufwärtsbewegung und Abwärtsbewegung an einer Schräge oder einer Treppe

pe, wie beispielsweise einem Treppenlift, einer Treppengehilfe oder einem Rollstuhl, wobei die Vorrichtung (1) entlang wenigstens einer langgestreckten Führung (2), die entlang der Schräge oder der Treppe angeordnet ist, verschiebbar ist, und mit:

- einem Wagen (3), der entlang der Führung (2) bewegbar ist, wobei der Wagen einen Rahmen (10) aufweist, und auf welchem Wagen eine Hilfseinrichtung für die Aufwärtsbewegung oder Abwärtsbewegung, wie beispielsweise ein schwenkbarer Sitz oder eine Hebeplattform angeordnet ist; und
- wenigstens einem Antriebsmechanismus (11), der für das Eingreifen in die Führung (2) am Wagen (3) montiert ist,

**dadurch gekennzeichnet, dass** der Antriebsmechanismus im wesentlichen kugelförmig ist und dabei ein Kugelgelenk bildet.

2. Vorrichtung nach Anspruch 1, wobei wenigstens zwei Antriebsmechanismen (11) jeweils ein Kugelgelenk bilden, die mit dem Wagen (3) verbunden sind, wobei diese wenigstens mit Bezug auf die Position des Antriebsmechanismus (11) relativ zu dem Wagen (3) und der Führung (2) voneinander unabhängig sind.
3. Vorrichtung nach Anspruch 1 oder 2, wobei wenigstens ein Antriebsmechanismus (11) mit einem Antrieb (21) zum Vorrücken des Wagens (3) entlang der Führung (2) verbunden ist.
4. Vorrichtung nach Anspruch 2 und 3, wobei jeder der wenigstens zwei Antriebsmechanismen (11) mit einem separaten Antrieb (21) verbunden ist.
5. Vorrichtung nach einem der vorstehenden Ansprüche, wobei zwischen dem Wagen (3) und dem wenigstens einen Antriebsmechanismus (11), der ein Kugelgelenk bildet, eine Begrenzungseinrichtung (23) angeordnet ist, um die Position desselben relativ zu dem Wagen (3) und zur Führung (2) zu begrenzen.
6. Vorrichtung nach einem der vorstehenden Ansprüche, wobei wenigstens ein Stützrad (13) im Inneren des wenigstens einen kugelförmigen Antriebsmechanismus (11) angeordnet ist.
7. Vorrichtung nach einem der Ansprüche 3 bis 6, wobei wenigstens ein Antriebsrad (19) im Inneren des wenigstens einen kugelförmigen Antriebsmechanismus (11) angeordnet ist.

## Revendications

1. Dispositif pour monter ou descendre un pan incliné ou un escalier, comme par exemple un ascenseur d'escalier, une aide à la marche dans un escalier ou un élévateur de fauteuil roulant, lequel dispositif (1) est déplaçable le long d'au moins un guide allongé (2) disposé le long du pan incliné ou de l'escalier, et comprend :

- un chariot (3) qui est déplaçable le long du guide (2), le chariot comprenant un cadre (10) et sur lequel peuvent être disposés des moyens d'assistance pour monter ou descendre, comme par exemple un siège pivotant ou une plateforme d'élévateur; et
- au moins un mécanisme d'entraînement (11) monté sur le chariot (3) pour coopérer avec le guide (2),

**caractérisé en ce que** le mécanisme d'entraînement est sensiblement en forme de rotule et est raccordé au cadre (10) en formant un joint à rotule.

2. Dispositif selon la revendication 1, dans lequel au moins deux- mécanismes d'entraînement (11), formant chacun un joint à rotule, sont raccordés au chariot (3), dans lequel au moins en rapport avec la position les mécanismes d'entraînement (11) sont indépendants l'un de l'autre par rapport au chariot (3) et au guide (2).
3. Dispositif selon la revendication 1 ou 2, dans lequel le au moins un mécanisme d'entraînement (1) est raccordé à une unité d'entraînement (21) pour faire avancer le chariot (3) le long du guide (2).
4. Dispositif selon les revendications 2 et 3, dans lequel l'un ou l'autre des au moins deux mécanismes d'entraînement (11) est raccordé respectivement à une unité d'entraînement séparée (21).
5. Dispositif selon l'une quelconque des revendications précédentes, dans lequel entre le chariot (3) et le au moins un mécanisme d'entraînement (11) formant un joint à rotule est disposé un limiteur (23) servant à limiter sa position par rapport au chariot (3) et au guide (2).
6. Dispositif selon l'une quelconque des revendications précédentes, dans lequel au moins une roue de support (13) est disposée à l'intérieur du au moins un mécanisme d'entraînement (11) en forme de rotule.
7. Dispositif selon l'une quelconque des revendications 3 à 6, dans lequel au moins une roue motrice (19) est disposée à l'intérieur du au moins un mé-

canisme d'entraînement (11) en forme de rotule.

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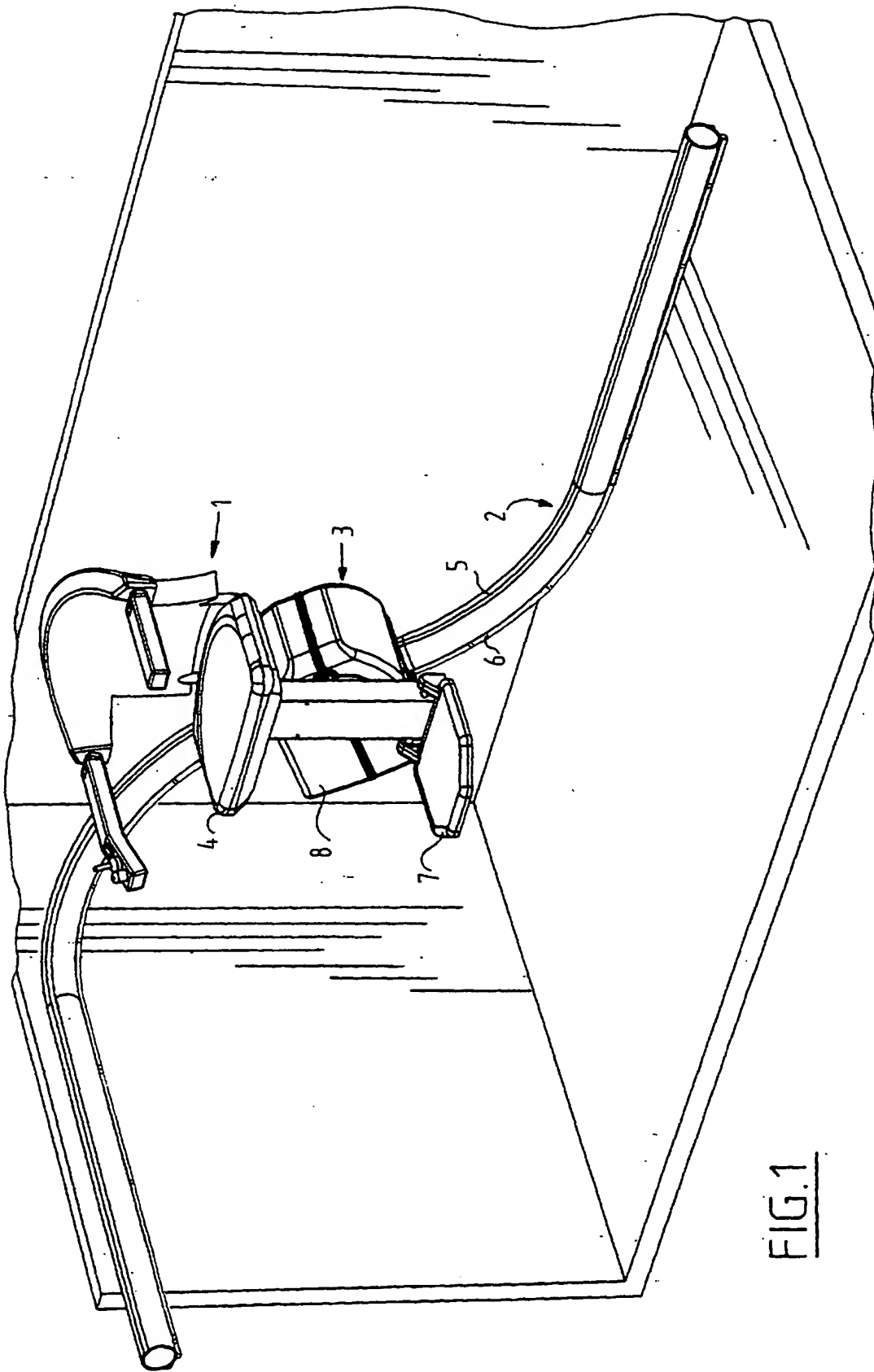


FIG.1

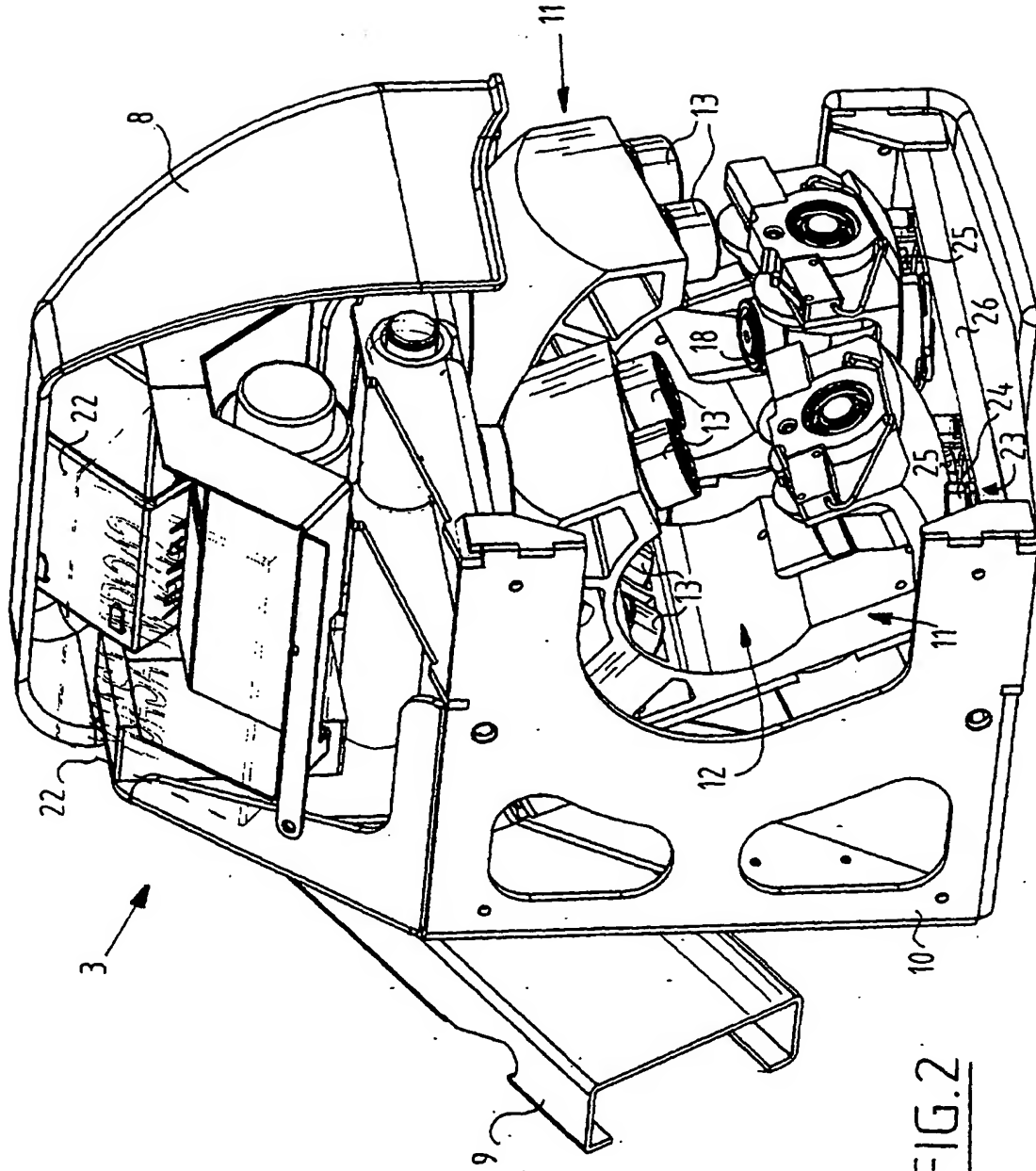
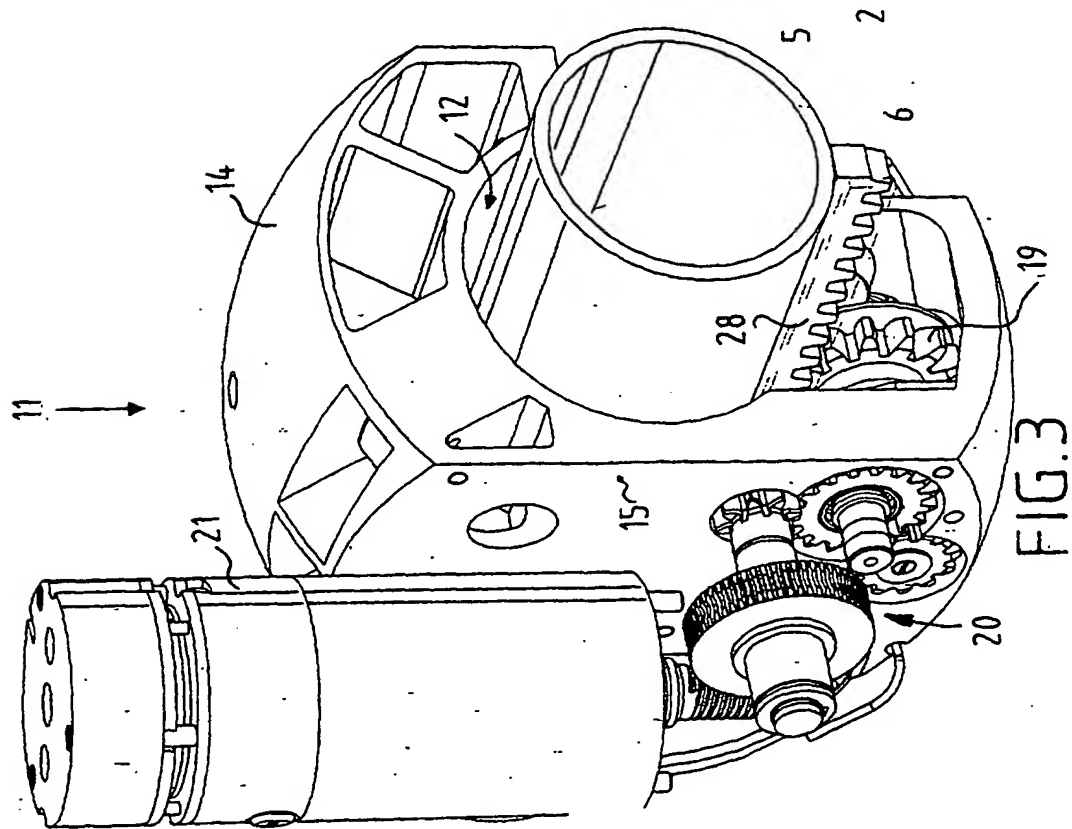
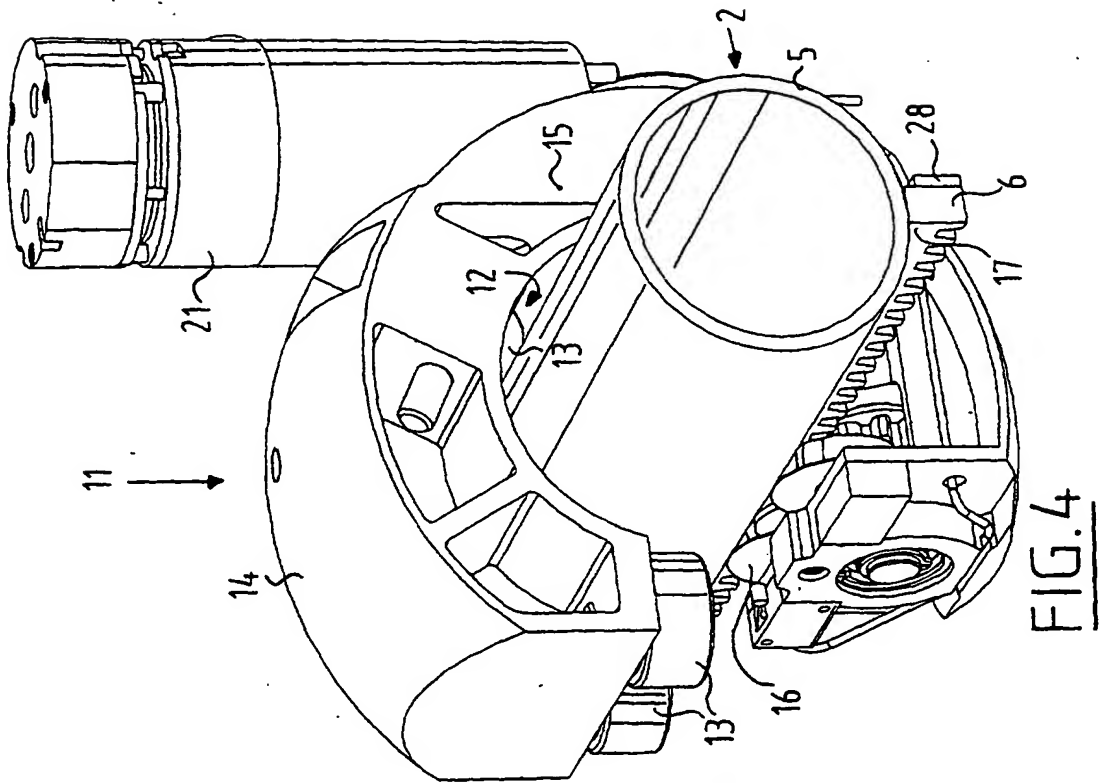


FIG. 2





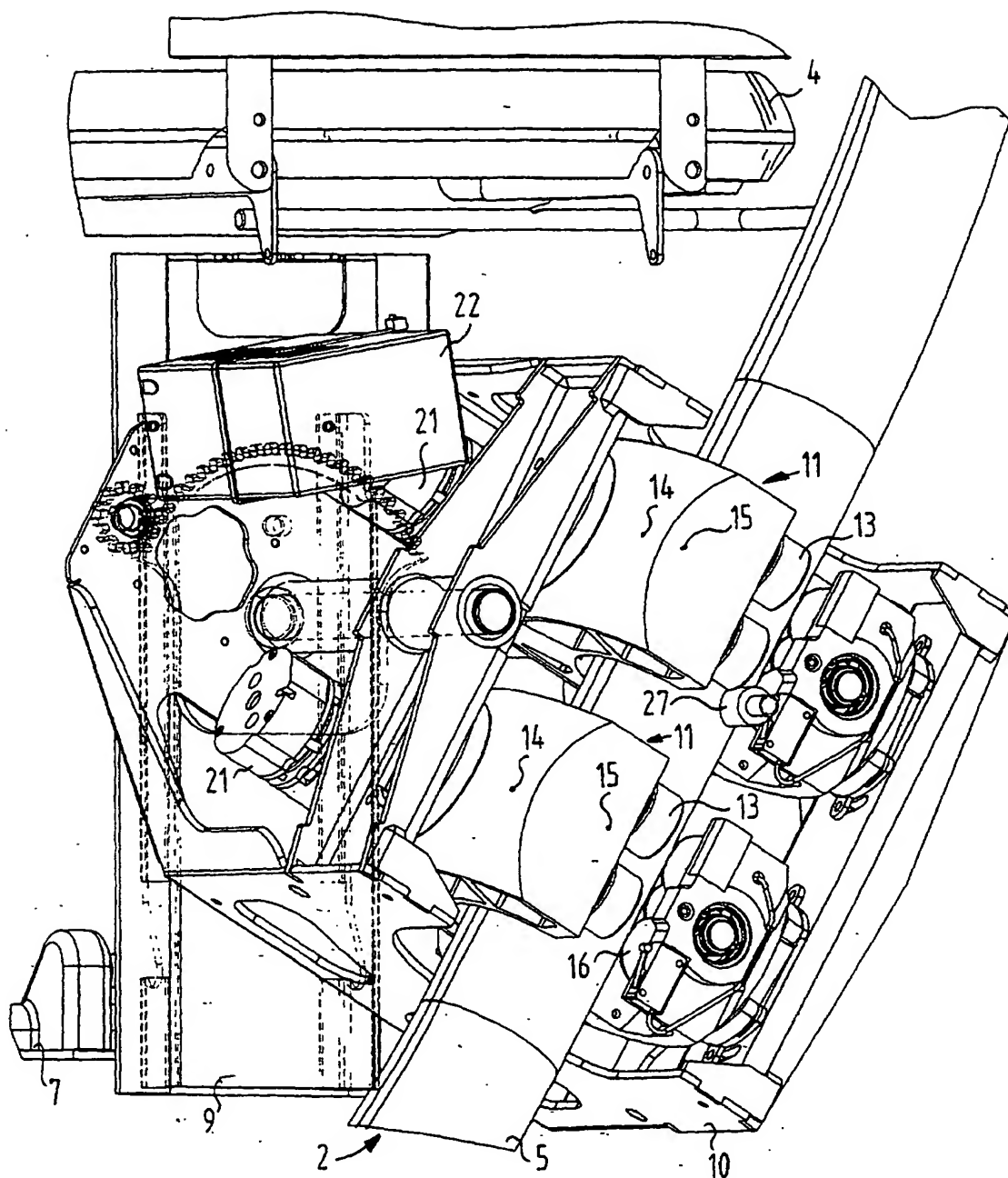


FIG. 5